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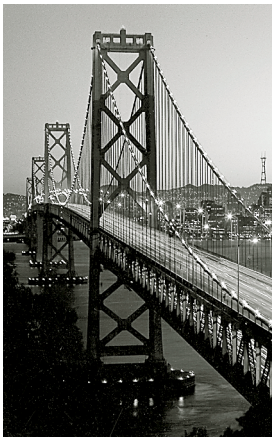


PERFORMANCE MEASURES REPORT FOR THE 2001 REGIONAL TRANSPORTATION PLAN FOR THE SAN FRANCISCO BAY AREA

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Overview

The Performance Measures Report is a new feature of the 2001 Regional Transportation Plan (RTP). The Metropolitan Transportation Commission (MTC) has pursued the development of performance measures with three purposes in mind:

1) to define quantifiable performance measures for long range transportation planning;

2) to test the efficacy of the measures by analyzing three alternative long-term transportation investment strategies described in the RTP Draft Environmental Impact Report (DEIR); and

3) to develop suggestions for improving the use of performance measures in future RTPs.

MTC's effort reflects a national trend to incorporate system performance measurement in the transportation planning process. Performance measurement is viewed as a tool to inform investment decisions and increase accountability for these decisions. Current efforts also place greater emphasis on making performance data accessible to the public, through readily-understood measures.

Performance measurement is hardly new to the field of transportation. What is new is the strong emphasis on how the customer experiences the performance of the transportation system (customer-based measures) and institutional accountability. Traditionally, measures of performance have reflected the interests of the providers of transportation facilities and services and have tended to measure "outputs" rather than "outcomes". For example, the number of new lane miles of roadway provided in a program or plan is an output, whereas the travel time savings for the customer is an outcome, and one that is important to system users. The shift in focus to the customer's perspective also requires that a more holistic view of the system be taken, one that accounts for the fact that many trips involve multiple travel modes (automobile, transit, biking and walking).

Other transportation agencies are integrating performance measures into their planning process as well. The California Department of Transportation has been engaged in a multi-year effort to identify performance measures for use in the California Transportation Plan and in statewide monitoring efforts. In 2000, the California Legislature passed AB 2140 which encourages the use of performance measures in long range plans for metropolitan regions. Subsequent legislation currently before the legislature (SB 473) would require MTC to expand upon the current initiative by developing measurable performance objectives for major travel corridors identified in the RTP and to evaluate new projects that are proposed to be added to the RTP.

Planned future work by MTC also includes development of a monitoring program to gauge how the existing transportation system is performing. Periodic updates of the information would be included in a "state of the system" report to the public. This monitoring program could include important types of data that cannot be forecasted and are therefore difficult to assess in plans that cover extended periods in the future. Examples include trends in safety and system reliability.

This report is organized into four chapters:

- Chapter 1 provides an overview of the RTP and the process used to develop the RTP performance measures.
- Chapter 2 provides general descriptions of the measures themselves.
- Chapter 3 summarizes the results of the performance analysis. Subsequent work may be needed to revise or refine the measures based on the information in this report.
- Chapter 4 provides observations and suggestions for consideration in future work.

Appendix A, included at the end of this report, contains tables showing the detailed results of the analysis for all measures in the report.

The report has two additional appendices that are available as a separate document from the MTC-ABAG Library: Appendix B contains detailed, technical descriptions of the methodologies used to calculate the performance measures; Appendix C contains meeting summaries from all of the meetings of the Performance Measures Working Group, the stakeholder group that advised MTC staff in development of the performance measures for this report.

Chapter 1
Performance Measures Development Process

1.1 Overview of the 2001 RTP

The 2001 RTP will guide the transportation investments in the nine-county Bay Area for the next 25-years. MTC is required by state and federal law to update the RTP at least every three years using the latest projections of population and employment growth and estimates of future transportation funding levels. The 2001 RTP identifies six broad goals:

- Mobility of people and freight
- Safety
- Economic vitality
- Community vitality
- The environment
- Equity

The 2001 RTP estimates that funding for transportation over the next 25 years will total $82 billion (in 2001 dollars). Roughly 90% of the funding ($74 billion) is dedicated to prior funding commitments. These commitments include the region's adopted three-year Transportation Improvement Program (TIP), transportation projects funded through voter-approved county sales initiatives, and the long term costs of operations, management, and maintenance/rehabilitation of existing roads and transit systems. The remaining $7.7 billion is new discretionary federal and state funding that will be generated over the planning period and must be divided between maintenance shortfalls, system management and customer service programs, and system expansion.

1.2 Transportation Alternatives in the RTP Environmental Impact Report (EIR)

The RTP is developed in consultation with Bay Area transportation agencies, other regional agencies, and the public. The proposed investments in programs and projects recommended by MTC is then released for further review and comment. In addition, MTC prepares a companion draft environmental impact report (DEIR) which considers the impact of the proposed RTP along with various transportation alternatives to the RTP. MTC solicited comments on these alternatives and ultimately defined three new alternatives to the RTP "Project" alternative analyzed in the DEIR. These alternatives are substantially different in terms of the mix of projects and programs and are therefore deemed to be a good test of how performance measures can be applied to discern differences in the performance of the overall transportation system. The alternatives evaluated in the DEIR are described in Figure 1.

Figure 1: 2001 RTP Alternatives

No Project Alternative (Baseline for purposes of the DEIR)

Highway, transit, local roadway, bicycle, and pedestrian projects that are reasonably foreseeable, that will go forward, primarily based on current funding commitments. These projects are identified in the federally required 2001 Transportation Improvement Program (TIP) and include fully funded sales tax projects authorized by voters in Alameda and Santa Clara Counties during the November 2000 election.

Proposed "Project" Alternative (Financially constrained)

The financially constrained RTP proposed for Commission adoption in November 2001. Projects in this alternative are based on MTC's regional priorities (e.g., filling transit operator shortfalls, pavement shortfalls on the metropolitan transportation system (MTS), and system management programs) and the county congestion management agency (CMA) adopted project lists.

System Management Alternative (Financially constrained)

This alternative includes a set of projects that could address corridor mobility issues that are primarily operational in nature, such as more express bus service, reversible carpool lanes, and a better connected HOV and transit system. It also provides more funding for streets and roads pavement shortfalls. Freeway ramp metering is assumed for the most congested corridors. Congestion pricing is assumed on the Bay Bridges to generate additional revenues, including transit operating revenues, and some highway projects are deferred to provide additional capital funding.

Blueprint 1 Alternative (Not financially constrained)

The 2001 RTP plus Blueprint projects that could be funded if new revenue sources are developed. These are reasonable revenue sources to consider as they represent extensions of existing funding sources, higher levels, or legislative authorization exists to pursue a particular fund source, but has not taken place. Potential sources of new revenue include up to a 10-cent Regional Gas Tax, Bridge Tolls, new and extended sales taxes in various counties, BART bonds, and continuation of higher state transportation funding levels as recently provided in the Governor's 2000 Transportation Congestion Relief Program.

Blueprint 2 Alternative (Not financially constrained)

This set of projects include a number of projects considered in MTC's 2000 *Transportation Blueprint for the 21st Century*. Many of these projects are being considered in other ongoing planning studies, including expanded ferry service, a California High Speed Rail system, and other long-term highway and transit improvements. For many of these projects a funding source has not yet been identified. This alternative is in addition to projects in Blueprint 1 and therefore provides the most extensive set of transportation projects that could be funded with the most optimistic assumptions about future revenues.

1.3 PERFORMANCE MEASURES DEVELOPMENT PROCESS

Recognizing that considerable work has been done in the transportation field on the topic of performance measures, MTC retained the Institute of Transportation Studies (ITS) at UC Berkeley in the fall of 2000 to conduct a review of existing literature and to identify a set of candidate performance measures for the RTP. The ITS team considered nearly 200 measures and

ultimately identified roughly 30 for further consideration. The results of this study were published in a report, "Background Studies on Performance Measurement for the Metropolitan Transportation Commission" (January 2001) which is available from the MTC-ABAG Library.

Following this research phase, MTC convened a stakeholder working group representing the environmental community, business community, and MTC's transportation partners in early 2001. The role of the stakeholder group was to review and advise MTC on a final set of measures for incorporation into the current RTP planning process. Major considerations in this review were:

- Ensure relevance of the measures to the actual RTP investment decisions as much as possible,
- Work within the existing capabilities of the MTC travel demand forecasting model[1], at least for now.
- Identify measures that are relevant to users (customers) of the transportation system.
- Identify measures that are relevant across multiple transportation modes.
- Identify measures that are relevant for all trips, not just work trips.
- Identify measures that are sensitive to policy issues, such as changes in land use and transportation system pricing, as well as investment decisions.

The working group engaged in extensive discussion about the usefulness of specific measures as applied to the six RTP goals, the capabilities of the regional travel model, methodologies for calculating specific measures, and the scale of the analysis (e.g., analysis of the RTP as a whole or of specific projects contained in the RTP). Due to the complexity of the topics, diversity of views, and the need to make progress in a short period of time, MTC retained a professional facilitator to assist with the process. Ultimately, the working group was able to identify a short list of measures shown in Figure 2. This list was subsequently approved by the MTC's Planning and Operations Committee in June 2001.

The selection of this initial set of performance measures was based on the following understandings:

- First, the Performance Measures Report for the 2001 RTP is considered an important first step in which the initial set of measures will be used to test their ability to draw useful distinctions between the performance of alternative RTP investment packages. It is not expected that the measures will be used for selection of a preferred RTP alternative at this time, given the early stage of their development.

- Second, several performance measures were actively discussed, but did not have sufficient support from the group for inclusion in the short list. (See Figure 3.) Developing information on these measures would be a lower priority and would be conducted as time allowed. (In the end, there was not sufficient time to include them in

[1] This computer model is developed and maintained by MTC to forecast future travel behavior given a range of socio-economic variables, future regional demographics, and potential transportation investments.

this report given other more pressing analyses required to produce the draft RTP and EIR.)

- Third, there is a need for a work plan to continue the development of performance measurement. Continuing work will most likely focus on: 1) refining the use of performance measures in the RTP; 2) responding to the requirements of SB 473 if passed into law, and 3) developing a program to monitor performance of the existing system.

Figure 2: Performance Measures Selected for the 2001 RTP

RTP Goal	Performance Measures
Mobility of people and freight	Travel time: aggregate travel time and travel time distribution (average, median, and 90th percentile travel times) Travel time between selected geographic origins and destinations Accessibility to jobs and shopping opportunities
Safety	No measures included. Difficult to assess impacts of future RTP investments on safety for system users and for different travel modes given tools at hand.
Economic vitality	Accessibility of regions work force to employers Economic efficiency of transportation investments (value of travel time as well as user costs and public expenditures)
Community vitality	Population and employment within walking distance of transit intermodal/rail stations Use of walking to access transit
The environment	Air quality and global warming – vehicle emissions
Equity	Comparison of changes in: • Travel time: aggregate, median, 90th percentile • Accessibility to jobs • Transit travel time from target communities to major job centers for low-income and minority communities relative to other communities

Figure 3: Performance Measures Identified for Testing

RTP Goal	Performance Measures
Mobility of people and freight	Accessibility to shopping opportunities based on a threshold number of retail jobs
	Person trips in the peak period
Economic vitality	Economic efficiency measured as net discounted benefits, accounting for the value of travel time as well as user costs and public expenditures
	Inclusion of safety and air quality costs and benefits in the calculation above (to be conducted by interested working group members).

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Chapter 2
Overview of Individual Performance Measures

This chapter provides general descriptions of the performance measures selected for each RTP goal, as shown in Figure 2. The discussion addresses why the measures were chosen and what they are intended to demonstrate.

2.1 MOBILITY OF PEOPLE AND FREIGHT

The measures selected for this goal address travel time and accessibility, two critical aspects of mobility from the customer's perspective. Travel time is fairly intuitive as a good measure of mobility since it is a primary concern for those making both work and non-work trips. Accessibility refers to the ability to reach desired destinations within a reasonable amount of time and is affected by local land use as well as transportation decisions. Mobility improves if travel time decreases or people can get to more desired destinations within a given amount of travel time. These measures are relatively easy to calculate from the MTC travel demand forecasting model.

Measure 1: Aggregate Travel Time and Travel Time Distribution

Some travelers have very short travel times while others have very long travel times, depending on the type of trip and desired destination. The projected time spent by people in the Bay Area for work and non-work travel in the future can be analyzed with standard statistical measures as shown below. Travel times can also be calculated for trips made by trucks transporting goods. At the regional level, the measure includes:

- Aggregate travel time (the sum of individual travel times for all system users for an average day);
- Average travel time (aggregate travel time divided by the total number of trips);
- Median travel time (the midpoint where 50% of trips are shorter in time and 50% are longer);
- 90^{th} percentile travel time (the point at which only 10% of trips are longer in time).

Measure 2: Travel Time between Selected Origins and Destinations

This measure is useful for assessing how proposed future transportation investments in a corridor affect travel time for users of various modes (people who drive alone, people who carpool, and people who take transit). The origins and destinations are selected to be representative of the trips most likely to be affected by the proposed RTP investments. The primary focus is on investments that would increase capacity in a corridor, such as major rail extensions or bus service enhancements, new carpool lanes, and highway widenings.

Measure 3: Accessibility to Jobs and Shopping

Accessibility is a significant measure of mobility because transportation is rarely an end in itself; it is most often a means for getting to other activities. Accessibility is defined as the share of all regional work and shopping opportunities (retail jobs are used as a proxy for shopping opportunities) that Bay Area residents can reach within specified amounts of time

from their neighborhood of residence[2]: 15, 30, and 45 minutes by automobile or transit; and 15 and 30 minutes by biking or walking.

2.2 SAFETY

Safety was added this year as an RTP goal, primarily in response to comments received during public outreach about pedestrian safety and transit security. While an important goal, the working group found it difficult to say how user safety would change in the future and how these changes could be forecast using the regional travel demand model. There are multiple dimensions to safety concerns for any particular mode; for example, transit has security issues on vehicles, in parking lots, at stations, as well as safety concerns associated with grade crossings where train tracks cross local roads at grade. More useful assessments of safety issues would probably be made at the project development level. However, having said this, the group did feel that monitoring of safety impacts was something that could be achieved in the forthcoming system monitoring effort.

2.3 ECONOMIC VITALITY

The gross regional product (GRP) of the Bay Area rivals that of many countries. If the Bay Area were its own country, the regional GRP would rank about 24th in the world. Transportation plays a significant role in the economic health of all metropolitan regions; yet it is difficult to make a direct connection between transportation investment and economic output. The two performance measures selected for this goal take very different approaches. The first, access of employers to the region's workforce, is based on the theory that companies will find it easier to attract and retain employees and employees will be more productive if they spend less time getting to work. The second measure, economic efficiency, addresses the use of valuable capital for making investments in transportation. Basically, the expenditure of transportation funding on future improvements should generate benefits (such as travel time savings) of greater value than the funds invested. Also note that the travel time and accessibility measures under the Mobility Goal (Measures 1, 2, and 3), are reflective of the RTP Economic Vitality Goal.

Measure 4: Access of Employers to the Region's Workforce

Accessibility to employed residents of the Bay Area is an important consideration in business location decisions. This measure calculates the number of workers located within various travel time intervals of eighteen major regional job centers.

This measure is essentially the other side of the coin for Measure 3 (Access to Jobs), which calculates the number of jobs that can be reached from home for employed residents of the Bay Area. As for Measure 3, travel times are defined to be 15, 30, and 45 minutes for auto and transit, and 15 and 30 minutes for biking and walking.

Measure 5: Economic Efficiency – Net Benefit and Benefit Cost Ratio

The economic efficiency of transportation investment decisions is of concern for two reasons: first, the revenues spent on projects are generated through user fees and taxes and entrusted to transportation agencies to spend wisely; second, projected transportation

[2] For regional transportation planning, the Bay Area is divided into 1,099 neighborhoods (travel analysis zones).

revenues are not enough to meet Bay Area transportation needs. These circumstances provide a motivation to measure the comparative benefits of different types of transportation investments at the regional/system level. Project level analyses are typically performed in corridor and major investment studies to evaluate investments choices at a smaller scale.

This measure calculates the user benefits of a transportation investment alternative and the public costs of that alternative in order to assess cost effectiveness. All other things being equal, a transportation investment alternative that provides a greater level of user-benefit for the same or less public cost than another transportation investment alternative is considered a better use of resources.

The measure can be expressed in two forms:

(1) Net benefit which is calculated by subtracting the total annualized cost from total annual user benefits

    Net Benefit = [total benefits] – [total cost]

(2) Benefit cost ratio which is calculated by dividing total benefits by total costs.

    Benefit Cost Ratio = [total benefits] ÷ [total costs]

Benefits include travel time saved by system users (as measured in Measure 1) and reductions in out-of-pocket expenses such as transit fares, parking fees, and auto operating costs (fuel costs and automobile wear and tear). The travel time saved by users is assigned a monetary value in order to compare it directly with the costs. The costs include annualized public expenditures on construction, operation, and maintenance of new transportation facilities and services.

This report includes economic efficiency calculations for the RTP Project Alternative. It does not include calculations for the other alternatives in the DEIR since the cost information was less detailed. Continuing work to be conducted this fall will provide a more complex calculation based on a discounted stream of future costs and benefits, which will be summed over the full 25-year planning period.

2.4 COMMUNITY VITALITY

The working group found it very difficult to define what constitutes “community vitality”, and therefore, to develop focused performance measures for this RTP goal. Furthermore, the effect of transportation investment on community vitality is not straightforward. After discussion with the Commission, two performance measures were identified that focused on the connection between transit and community vitality: the number of people and jobs within walking distance of transit and the number of transit trips that involve walk access to transit.

Measure 6: Population and employment within Walking Distance (1/2 mile) of Transit
Residents in communities with good access to transit and residents of new developments specifically oriented around major transit stops have more choices in terms of how they get

to work, shopping, or entertainment destinations. The pedestrian activity in and around transit stations can enhance the feeling of cohesiveness within neighborhoods as well as stimulate commercial activity along the routes to the transit stations.

This measure is based on estimates of the population and employment within walking distance (1/2 mile) of defined major bus, rail, and ferry stops. For this analysis, the land use assumptions are provided by ABAG and are constant; therefore, differences between alternatives will reflect the impact of new or expanded transit service. In the future, it will be possible to factor in land use changes where local jurisdictions have made a commitment to transit-oriented development and increased residential densities near transit centers. This measure is also used for evaluating transit projects proposed for federal funding programs for transit, such as the New Starts Program, for the reason just noted.

Measure 7: Transit Trips with Walk Access

This measure calculates the number of transit trips where access to the transit stop is by walking as opposed to driving. Whereas Measure 6 estimates the potential for walk access to transit based on the number of people located around transit stops, this measure forecasts the actual number of walk-access-transit trips as projected by the MTC travel demand forecast model.

2.5 THE ENVIRONMENT

Different transportation system investment alternatives will produce varying amounts of vehicle activity as a result of the mix of projects that affect travel time and cost among alternatives. Because certain air quality pollutants are regional in nature and because transportation sources are a major contributor to these pollutants, the environmental performance measure selected is vehicle emissions. The measure is defined to address health based air quality (ozone, particulates, and carbon monoxide) as well as transportation contributions to global warming (carbon dioxide). Ozone, or smog, is formed by a photochemical reaction involving reactive organic gases (ROG) and nitrogen oxide (NOx). Particulates are very small particles that can enter the lungs and cause respiratory illness. Particulates are formed by engine combustion and by travel over roads which kicks up road dust. While not subject to state or federal regulation, CO_2 is of interest since it is known to contribute to global warming. Federal and state air quality standards are in effect for the health based pollutants; however, there is no regulatory framework for moderating carbon dioxide emissions from mobile sources at present. Automobile emissions are stringently controlled by the California Air Resources Board; however, carbon dioxide emissions are strongly correlated with automobile fuel economy standards which have not changed for many years.

Measure 8: Air Quality and Global Warming – Vehicle Emissions

Depending on the specific pollutant, emissions are calculated by applying emission rates provided by the California Air Resources Board to vehicle activity forecasts, such as the number of vehicle trips, the amount of travel (vehicle miles of travel), and the average speed of travel. The major factors of interest are whether the emissions are increasing or decreasing over time and how emissions compare to the No Project Alternative, that does not provide any new transportation improvements beyond those that are already committed. Decreased

emissions indicate improved air quality trends, which is the case for some pollutants like ozone. Increased emissions indicate an increasing contribution from the transportation to pollutants. In addition, for ozone, MTC has a specific transportation emission budget identified in the federal air quality plan which must be maintained to demonstrate "conformity" with the air quality goals in that plan.

2.6 EQUITY

The performance measures for this goal are drawn from work conducted separately by the Environmental Justice Advisory Group to refine the social equity analysis methodology for the RTP. Consistent with federal Environmental Justice guidance, the social equity analysis assesses whether the RTP would produce disproportionately high and adverse human health or environmental effects on minority or low-income communities. The Environmental Justice Report is available as a separate report from the MTC-ABAG Library.

The equity performance measures assess mobility and accessibility of certain defined "target communities" compared to the rest of the Bay Area (non-target communities). The target communities are defined in the equity analysis as those communities in which the number of minority or low-income residents surpasses a defined threshold. Minority is defined as Black or African American, Asian American/Pacific Islander, Hispanic or Latino, and Native American. To account for the high cost of living in the Bay Area, low-income is defined as having household income at or below an amount that is twice the US Department of Health and Human Services Poverty Guidelines.

Measure 9: Travel time distribution for target communities
This measure is comparable to the more general measures of travel time distribution listed under the RTP mobility goal and is useful for the same reasons.

Measure 10: Accessibility to jobs from target communities
This measure is comparable to Measure 3, Accessibility to Jobs, listed under the RTP mobility goal and is useful for the same reasons. Accessibility is measured as the percent of all regional jobs within 15, 30, and 45 minutes of home by auto and transit.

Measure 11: Transit travel time from target communities to major job centers.
This measure reflects the important role that the quality and quantity of transit service plays in the mobility of low-income households, which generally have lower auto-ownership rates. The measure uses the same job centers used in Measure 4, Access to the Region's Workforce.

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Chapter 3
Testing Performance Measures Using RTP EIR Alternatives

This chapter contains the test results of applying the performance measures in Chapter 2 to the EIR alternatives listed in Figure 1. The analysis of each measure is presented in two parts. First, the changes over time in performance are discussed, that is performance measures are compared for 1998[3] and 2025. Second, the performance measures are tested by comparing differences among the transportation alternatives defined in the EIR for the year 2025 (Project, System Management, Blueprint 1, and Blueprint 2).[4]

As discussed above, the performance measure results are calculated using MTC's set of travel demand forecasting models. These computer models forecast future travel behavior based on socio-economic factors and assumptions about future demographics, land use, and changes to the roadway and transit networks and services. This chapter presents highlights of the results for each of the eleven performance measures; more detailed tables are presented in Appendix A.

3.1 Overview: Demographics, Transportation Supply, and Travel Behavior

It is helpful in reviewing the performance results to understand the basic assumptions about future demographics and transportation system supply (capacity). Table 1 shows projected changes in population, employed residents, and total employment between 1998 and 2025. Table 2 displays changes in the transportation capacity between the EIR alternatives, i.e., new lane miles of roadway and transit seats per hour. Each EIR alternative includes different amounts of funding for transit and highway maintenance and operations, system management, and system expansion. Of these categories, transportation expansion projects that add capacity will affect the performance measures to the greatest extent. System management/traffic operations programs that affect the flow of autos and transit vehicles through the system will have lesser effects on performance outcomes. Table 3 shows a snapshot of general travel patterns.

Table 1: Demographic Characteristics for 1998 and 2025

			Change: 1998 to 2025	
	1998	2025	value	pct
Total Population	6,716,000	8,224,000	1,508,000	22%
Employed Residents	3,738,000	4,625,000	887,000	24%
Total Employment	3,504,000	4,907,000	1,403,000	40%

[3] 1998 is the latest year for which the MTC travel demand model has been validated, or compared and adjusted to match real conditions.

[4] The RTP Environmental Impact Report actually defines two versions of the RTP Project Alternative. For this purposes of this analysis only the Project-A alternative is included. Project-B was not determined to represent a significantly different alternative since it is identical to Project-A except for transit service in two corridors. The Project-B service in these corridors is comparable to that in the System Management Alternative. Thus, the inclusion of Project-B would not have provided much additional information about the use of performance measures for a range of RTP alternatives.

Table 2: Transportation Capacity (Supply), 2025 EIR Alternatives

		2025 Alternatives				
	1998 Base	No Project	Project	System Management	Blueprint 1	Blueprint 2
Roadway Supply (lane miles)						
Freeways	4,400	5,400	5,600	5,700	5,800	5,800
Mixed flow	4,200	5,000	5,100	5,100	5,200	5,200
Carpool	300	400	500	600	600	600
Expressways	900	1,000	1,100	1,100	1,100	1,200
Mixed flow	900	1,000	1,000	1,000	1,100	1,100
Carpool	50	70	70	70	70	90
Arterial/other	14,000	13,600	13,600	13,600	13,600	13,600
TOTAL Roadway Supply	19,400	20,000	20,400	20,400	20,600	20,700
Transit Supply (seat miles per hour)						
Bus Transit	1,365,300	1,410,300	1,470,100	1,486,200	1,573,700	1,680,500
Light Rail Transit	143,000	249,900	268,100	268,900	275,100	328,500
Rapid Rail Transit (BART)	1,058,100	1,279,200	1,452,000	1,281,300	1,629,400	2,946,800
Commuter Rail Transit	473,000	645,200	672,600	822,700	1,416,000	2,149,300
Ferry Transit	96,700	115,900	115,900	115,900	238,600	597,300
TOTAL Transit Supply	3,136,200	3,700,500	3,978,700	3,975,000	5,132,800	7,702,300

	Percent Change	Percent Change Relative to No Project			
	1998 Base to 2025 Project	Project	System Management	Blueprint 1	Blueprint 2
Roadway Supply (lane miles)					
Freeways	27%	4%	6%	8%	9%
Mixed flow	23%	2%	2%	4%	4%
Carpool	104%	38%	59%	54%	68%
Expressways	18%	5%	5%	10%	17%
Mixed flow	17%	4%	4%	10%	16%
Carpool	40%	0%	0%	0%	29%
Arterial/other	-3%	0%	0%	0%	0%
TOTAL Roadway Supply	5%	2%	2%	3%	3%
Transit Supply (seat miles per hour)					
Bus Transit	8%	4%	5%	12%	19%
Light Rail Transit	87%	7%	8%	10%	31%
Rapid Rail Transit (BART)	37%	14%	0%	27%	130%
Commuter Rail Transit	42%	4%	28%	119%	233%
Ferry Transit	20%	0%	0%	106%	416%
TOTAL Transit Supply	27%	8%	7%	39%	108%

The magnitude of the demographic and geographic changes between 1998 and 2025 are significant: in 2025, there will be 1.4 million more jobs (40% increase) and 1.5 million more residents (22% increase), and a greater percentage of the regional growth will occur in outlying communities in the Bay Area.

In contrast, the underlying demographic assumptions are identical for all the EIR alternatives in 2025, and the only differences are in the capacity of the transportation network. Compared to the No Project, the Project Alternative makes relatively modest increases (4%) in overall freeway capacity due mostly to expansion of the region's carpool network (38%). The increase in transit capacity is also notable at 8% overall.

The System Management Alternative provides a slightly greater increase in roadway capacity on freeways, composed almost entirely of new carpool lanes. The primary characteristic of this alternative is the shift in emphasis of transit expansion to commuter rail and express bus from rapid rail transit.

The Blueprint 1 and Blueprint 2 Alternatives, which are not financially constrained, provide for significantly more investment much of which would be directed toward transit expansion. Both alternatives include a 9% increase in freeway capacity, composed largely of new carpool lanes. Blueprint 1 includes a 39% increase in transit capacity, with the largest increases in percent change in commuter rail and ferries. Blueprint 2 provides a 108% increase in overall transit capacity, with even larger increases in rapid rail transit, commuter rail, and ferries.

Table 3: Regional Travel Characteristics, 1998 and 2025

		2025 Alternatives				
	1998 Base	No Project	Project	System Management	Blueprint 1	Blueprint 2
Daily Person Trips by Mode						
Auto	16,986,000	21,597,000	21,566,000	21,555,000	21,536,000	21,536,000
Transit	1,129,000	1,585,000	1,618,000	1,631,000	1,653,000	1,653,000
Bike	270,000	346,000	343,000	343,000	342,000	342,000
Walk	1,855,000	2,699,000	2,700,000	2,697,000	2,695,000	2,695,000
TOTAL All Modes	20,240,000	26,227,000	26,227,000	26,227,000	26,227,000	26,227,000
Daily Transit Boardings	1,605,000	2,330,000	2,397,000	2,444,000	2,486,000	2,564,000
Daily Vehicle Trips	12,874,000	16,660,000	16,629,000	16,613,000	16,605,000	16,574,000
Daily Vehicle Miles of Travel	128,369,000	191,768,000	190,587,000	189,976,000	190,163,000	189,391,000
Daily Vehicle Hours of Delay	339,000	959,000	855,000	863,000	839,000	836,000
Avg Delay per Vehicle Trip (minutes)	1.6	3.5	3.1	3.1	3.0	3.0

	Percent Change	Percent Change Relative to No Project			
	1998 Base to 2025 Project	Project	System Management	Blueprint 1	Blueprint 2
Person Trips by Mode					
Auto	27%	-0.1%	-0.2%	-0.3%	-0.3%
Transit	43%	2.1%	2.8%	4.2%	4.1%
Bike	27%	-0.9%	-0.9%	-1.2%	-1.2%
Walk	46%	0.0%	-0.1%	-0.1%	-0.1%
TOTAL All Modes	30%	0.0%	0.0%	0.0%	0.0%
Daily Transit Boardings	49%	2.9%	4.8%	6.4%	9.4%
Daily Vehicle Trips	29%	-0.2%	-0.3%	-0.3%	-0.5%
Daily Vehicle Miles of Travel	48%	-0.6%	-0.9%	-0.8%	-1.2%
Daily Vehicle Hours of Delay	152%	-10.8%	-11.2%	-13.9%	-14.7%
Avg Delay per Vehicle Trip (minutes)	95%	-10.8%	-11.0%	-13.6%	-14.1%

3.2 MOBILITY OF PEOPLE AND FREIGHT

Measure 1: Aggregate Travel Time and Travel Time Distribution

See Table A-1 in Appendix A for the complete results for Measure 1.

Comparison of 1998 to 2025

Total aggregate travel time is expected to increase from 1998 to 2025 by 1.7 million person hours (75%) for work trips and by approximately 60,000 vehicle hours (58%) for truck trips. The number of trips also grows, though less than the aggregate travel time. This suggests that longer individual travel times per trip, not just growth in trips, account for the increase in aggregate travel time. Comparison of the average, median and 90th percentile travel times confirms that this is the case; for example, the average travel time for work trips increases by about 7 minutes and travel time for the 90th percentile increases by 14 minutes.

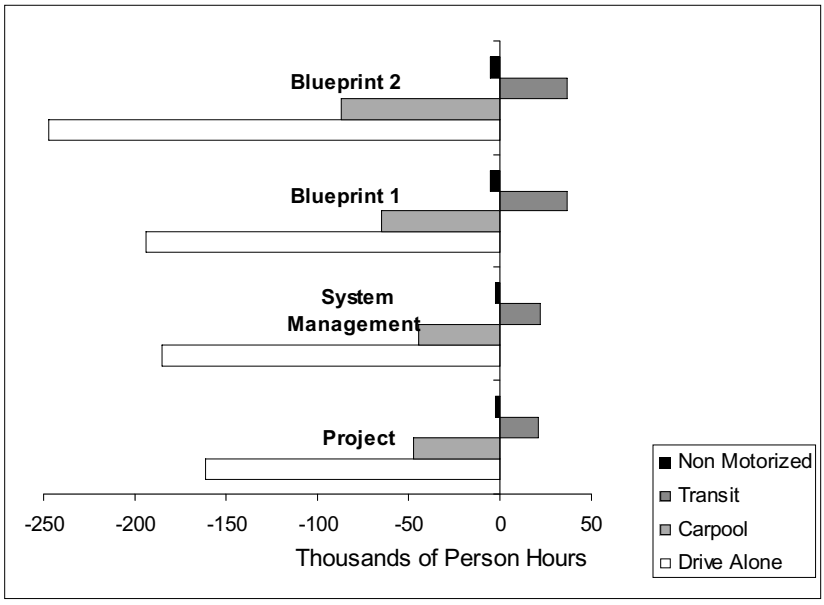
Comparison of Alternatives in 2025

Among the 2025 alternatives, larger investments in system expansion tend to correspond with larger decreases in travel time compared to the No Project Alternative. For example, person hours for work trips decrease by 301,000 (7%) in Blueprint 2; by 225,000 in Blueprint 1; by 210,000 in System Management; and by 189,000 in the Project. Though the System Management Alternative contains less system expansion than the Project Alternative, it offers a comparable decrease in aggregate travel time due to congestion pricing (higher peak period bridge tolls) and projects that improve travel time for drive alone and carpool trips.

The level of the decrease in aggregate travel time does differ among the transportation modes, as shown in Figure 4. The largest decrease in aggregate travel time occurs for drive alone trips, where small decreases in average travel time occur for a large number of trips. There are also significant decreases in travel time for carpools. Transit service improvements increase ridership in all the alternatives which leads to an increase in aggregate travel time for trips made by transit. (However, average transit travel times do not generally increase.) The slight decrease in the number of trips and aggregate travel time for non-motorized modes occurs because some former cyclists and walkers are attracted to the enhanced transit services.

The average, median and 90th percentile travel times for the 2025 alternatives also decrease compared to the No Project. Figure 5 shows that changes in the 90th percentile travel times are the most pronounced. For example, compared to the No Project, Blueprint 2 results in a 6 minute decrease in 90th percentile travel time for work trips.

Figure 4: Change in Aggregate Travel Time for Work Trips by Mode, 2025 Alternatives



Change in Number of Trip

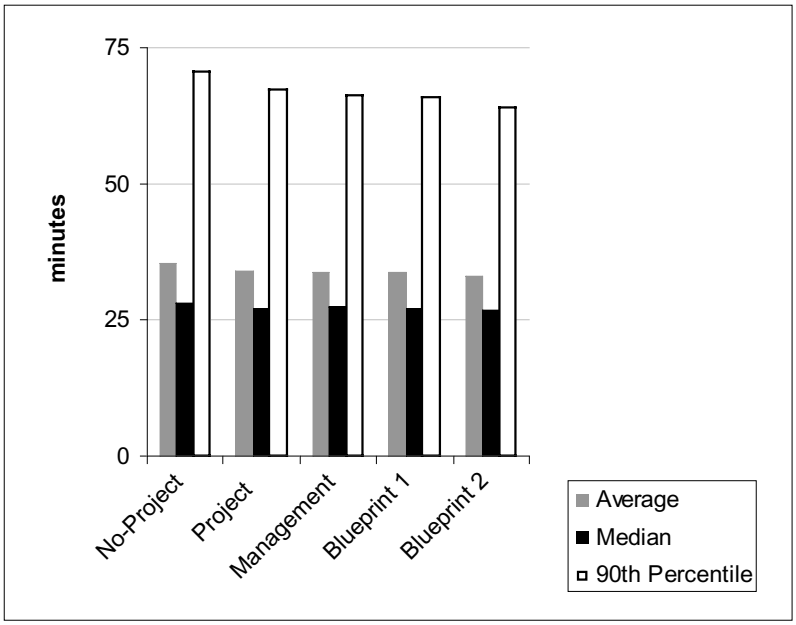
Blueprint 2
Non-Motorized: -3,000
Transit:: 64,000
Carpool: -13,000
Drive Alone: -49,000

Blueprint 1
Non-Motorized: -2,000
Transit:: 43,000
Carpool: -6,000
Drive Alone: -35,000

System Management
Non-Motorized: -2,000
Transit: 43,000
Carpool: -6,000
Drive Alone: -35,000

Project
Non-Motorized: -1,000
Transit: 21,000
Carpool: 0
Drive Alone: -20,000

Figure 5: Travel Time Distribution for Work Trips, 2025 Alternatives



Measure 2: Travel Times between Select Origins and Destinations

See Tables A-2(1) - (2) in Appendix A for the complete results for Measure 2.

The tables in Appendix A compare travel time for 41 origin-destination pairs for passenger travel and 12 origin-destination pairs for truck travel. Travel times are shown for 1998 and each of the 2025 alternatives.

Comparison of 1998 to 2025

For most origin-destination pairs, drive alone and truck travel times increase between the 1998 Base and the 2025 Project. The increase for drive alone trips is often 10 minutes or more. The addition of carpool lanes in many corridors causes carpool travel times to decrease or remain constant. Transit travel times improve in 2025 in some corridors due to service enhancements, new rail extensions, or carpool lane improvements that serve express buses. For example, in the Golden Gate Corridor new carpool lanes reduce carpool and transit travel times, while auto travel times increase. In the Fremont South Bay Corridor, BART and VTA light rail extensions reduce transit travel time, while auto travel times increase.

Comparison of Alternatives in 2025

With few exceptions, the 2025 alternatives offer travel time savings compared to the No Project. The System Management Alternative offers greater savings than the Project Alternative for drive alone, carpool, and truck trips where express bus services are added and where peak period bridge tolls affect travelers. Travel times in the Blueprint 2 Alternative tend to be comparable to or better than those in the other alternatives for all modes because it is the most inclusive of roadway and transit expansion projects.

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Measure 3: Accessibility to Jobs and Shopping

See Table A-3 in Appendix A for the complete results for Measure 3.

Comparison of 1998 to 2025

Figure 6 and Figure 7 show accessibility to jobs by auto and transit in 1998 and the 2025 alternatives. The figures show that, between 1998 and the 2025 Project, accessibility to jobs would generally decrease for auto, especially for longer trips, and increase for transit. These changes result from two factors: changing land use patterns over this period, and the transportation investments in the RTP Project itself. The decrease in accessibility to jobs by auto is primarily due to increases in travel times on the region's roadways and, to a lesser extent, changes in land use. The increase in accessibility by transit is due to significant transit improvements and to the overall growth in the number of jobs within the region.

However, even though the number of jobs accessible by transit increases by 2025, the share of all regional jobs accessible remains constant or decreases. This suggests that the location of these new jobs and new housing is more dispersed. On average, people will have access to a smaller share of the region's jobs in 2025 than they did in 1998.

Comparison of Alternatives in 2025

The 2025 RTP alternatives generally increase accessibility compared to the No Project. Figure 6 and Figure 7 show that as the amount of money spent on system expansion increases, so does accessibility to jobs. This is most apparent when considering the number of jobs accessible within 45 minutes. Compared to the No Project Alternative, the RTP Project offers access to an additional 81,000 jobs by auto and 4,000 jobs by transit within 45 minutes. Blueprint 2, with the largest budget for expansion, increases these numbers to 104,000 for auto and 23,000 for transit.

Figure 6: Accessibility to Jobs by Automobile, 1998 and 2025

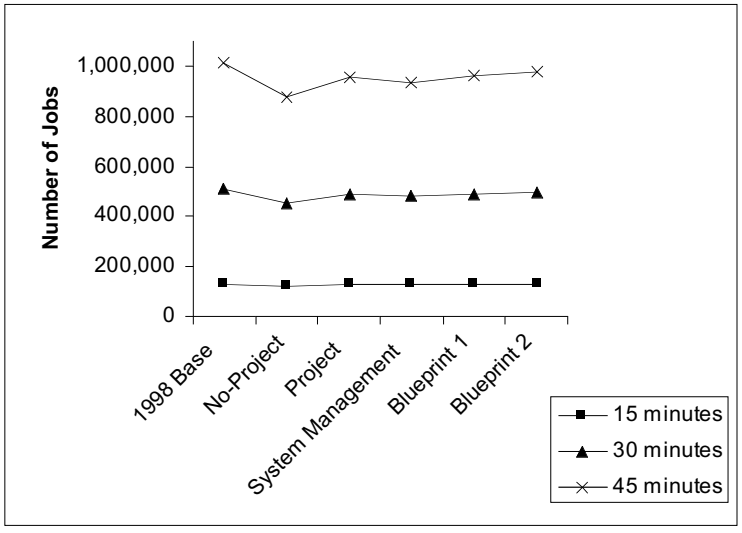


Figure 7: Accessibility to Jobs by Transit, 1998 and 2025

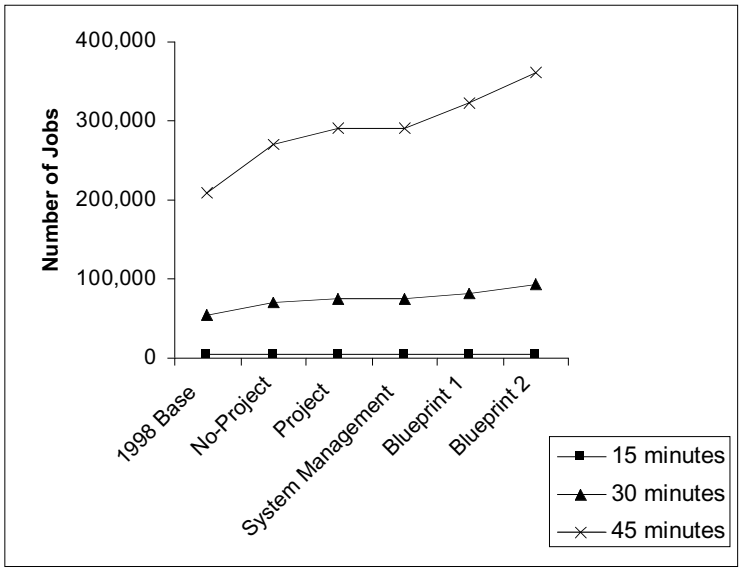
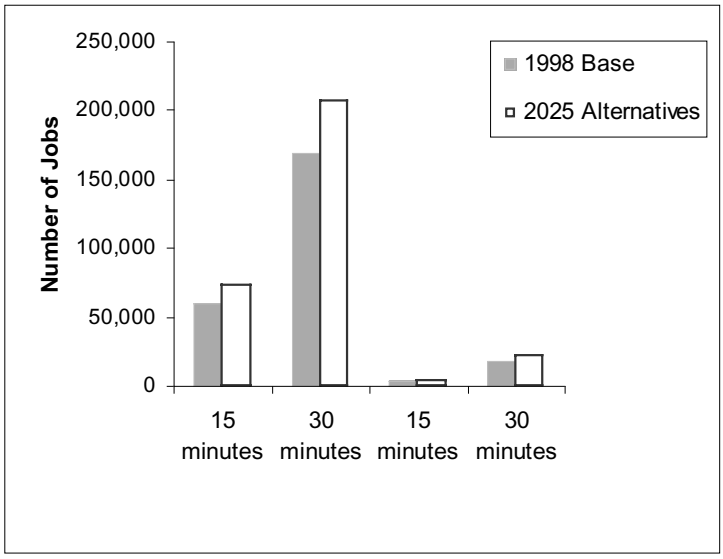


Figure 8 shows the number of jobs accessible by walking and biking in 1998 and 2025. It is interesting to note that for any given alternative, the numbers of jobs accessible by bicycle in 15 minutes and 30 minutes are comparable to those accessible by transit in 30 minutes and 45 minutes. These results are probably explained by the "access penalty" involved in transit travel. Even a short transit trip requires walking or driving to the transit stop and waiting for the vehicle; this time will amount to 15 minutes or more in most cases, particularly in communities located outside the urban core, where transit service is less frequent. The analysis does not include comparison of walk and bike access among 2025 alternatives because the MTC travel model would not calculate significant changes in non-motorized trips, absent changes in the underlying land use assumptions.

Figure 8: Accessibility to Jobs by Bicycle and Walking, 1998 and 2025



3.3 ECONOMIC VITALITY

Measure 4: Access of Employers to the Region's Work Force

See Table A-4 in Appendix A for the complete results for Measure 4.

Comparison of 1998 to 2025

This measure is the flip side of Measure 3, accessibility to jobs, since it uses the employment centers as the focus and measures the number of employees with access within specified travel time thresholds. As expected, the results are quite similar. Typically, the numbers of workers within each time interval decrease between 1998 and 2025 for access by automobile, and increase for transit, biking, and walking. The explanation is also similar: longer auto travel times decrease the number of workers with access to the jobs sites while improved transit services combined with overall population growth in the region increase the number of workers with access by transit, bicycling and walking.

Comparison of Alternatives in 2025

Likewise, the 2025 RTP alternatives offer increased accessibility compared to the No Project. Blueprint 1 and Blueprint 2 offer the biggest increase in accessibility, particularly by transit. This is due to the heavy investment in transit expansion in these alternatives. At the same time, none of the 2025 alternatives, not even Blueprint 2, restores the level of automobile access existing in 1998.

To illustrate this point, Figure 9 and Figure 10 show accessibility of the workforce to Downtown Oakland, one employment site.

Figure 9: Access to the Region's Workforce from Downtown Oakland - Auto, 1998 and 2025

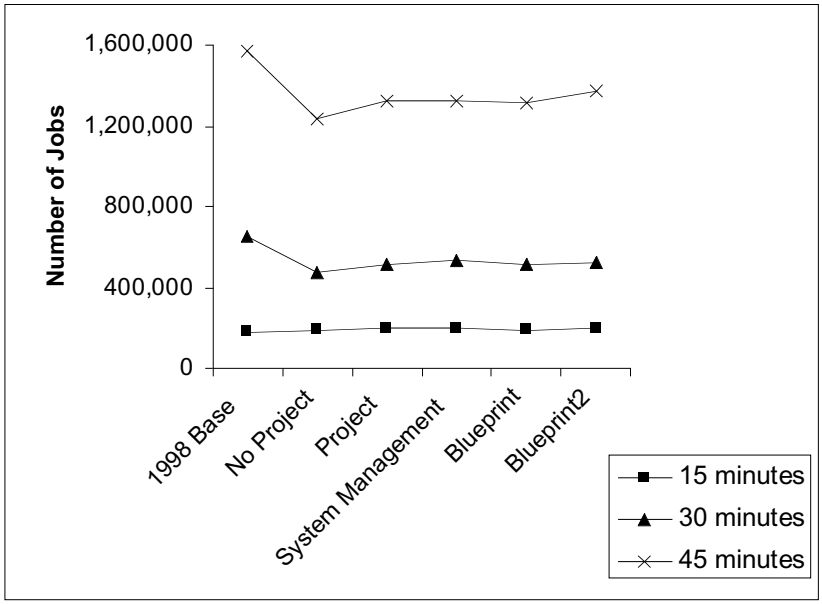
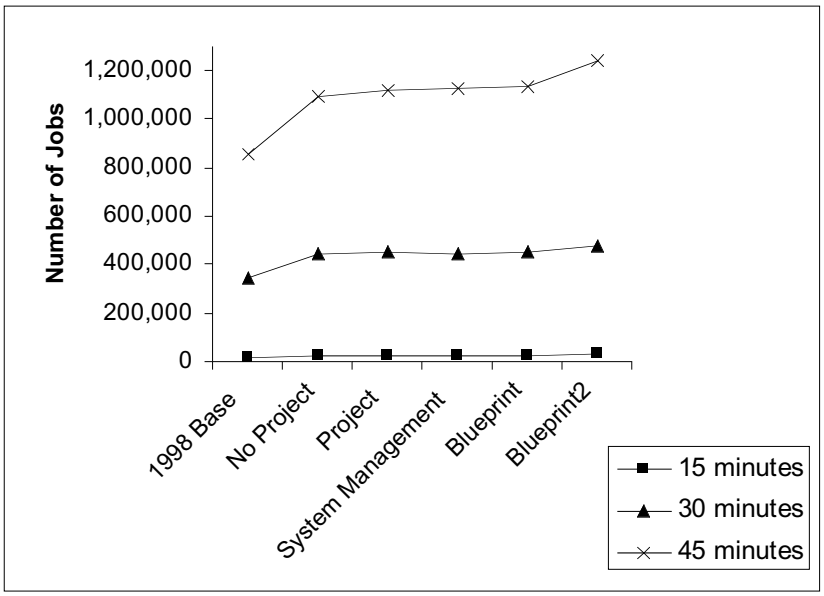


Figure 10: Access to the Region's Workforce from Downtown Oakland - Transit, 1998 and 2025



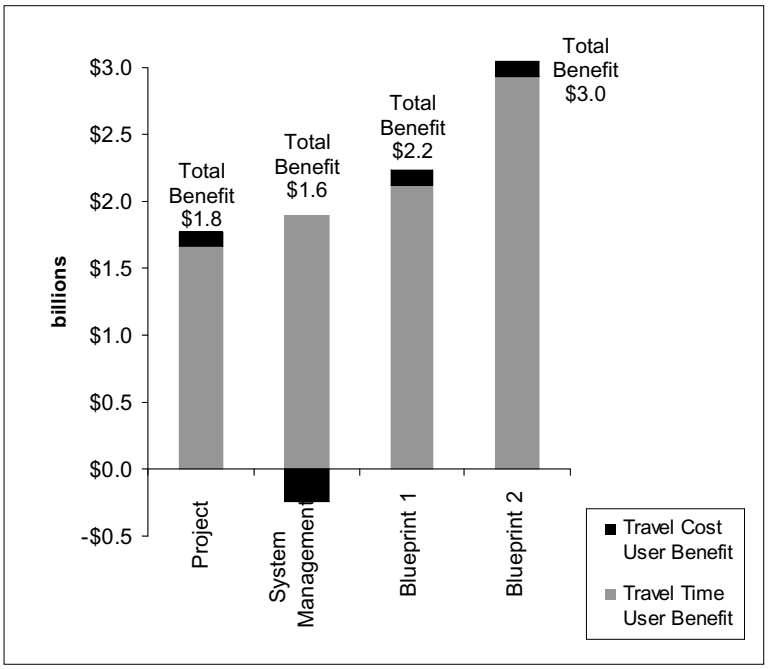
Measure 5: Economic Efficiency – Net Benefit and Benefit Cost Ratio

See Tables A-5(1) – (3) in Appendix A for the complete results for Measure 5.

Comparison of Alternatives in 2025

The economic efficiency measures compare user benefits (travel time savings and savings in out-of-pocket costs) with the incremental public expenditure for each 2025 alternative.[5] This analysis includes a calculation of user benefits for all the 2025 alternatives, and calculation of net benefit and benefit cost ratio for the Project Alternative only.

Figure 11: Value of User Benefits of 2025 Alternatives



* There is a net increase in out-of-pocket costs in the system management alternative due to increased peak period tolls. Revenues would typically be reinvested in transportation improvements and would generate additional revenues not reflected in this table.

Figure 11 shows that, as expected, increasing levels of investment generate increasing total user benefits. The RTP Project offers user benefits worth $1.8 billion; System Management offers $1.6 billion, Blueprint 1 offers just over $2 billion; and Blueprint 2 offers $3 billion. Most of the user benefit is generated by travel time savings for people and trucks. The change in out-of-pocket costs is small and nearly identical for all alternatives except the System Management Alternative, which costs people more due to

[5] Benefits are travel time savings and savings in out-of-pocket costs compared to the No Project Alternative. Similarly, public expenditures for each alternative are those expenditures on system capacity and system management beyond the No Project.

implementation of higher peak period bridge tolls. In reality, the revenues generated by new tolls would likely be reinvested in the transportation system and would generate additional user benefits that are not reflected in Figure 11. As a result, it is possible that the System Management Alternative would have a greater user benefit than the RTP Project Alternative.

The total annualized cost of projects and programs in the RTP Project Alternative is $777 million[6]. As shown in Table 4, this includes the annualized capital cost and annual operating cost for all new roadway and transit projects in the RTP Project Alternative.

Table 4: Total Public Expenditure, RTP Project Alternative ($millions)

	Transit Expansion	Roadway Expansion
Total Annualized Capital Expenditure	$ 498	$ 231
Total Annual Operations and Maintenance Expenditure	$ 43	$ 4
TOTAL Expenditure	$ 541	$ 235

The net benefit and benefit cost ratio calculations are shown in Table 5. The results suggest that for every dollar invested in the expansion projects in the Project Alternative, the region should realized more than $2 worth of benefits in terms of travel time savings and savings in out-of-pocket costs.

Table 5: Net Benefit and Benefit Cost Ratio, RTP Project Alternative

	Value
(a) Total User Benefits ($millions)	$ 1,771
(b) Total RTP Track 1 Public Expenditures ($millions)	$ 777
Net Benefit = (a) - (b) ($millions)	$ 994
Benefit Cost Ratio = (a) / (b)	2.3

[6] This number assumes a 4% discount rate. The measure was also calculated using a 7% discount rate. The results are shown in Tables A-5(2) - (3) in Appendix A.

3.4 COMMUNITY VITALITY

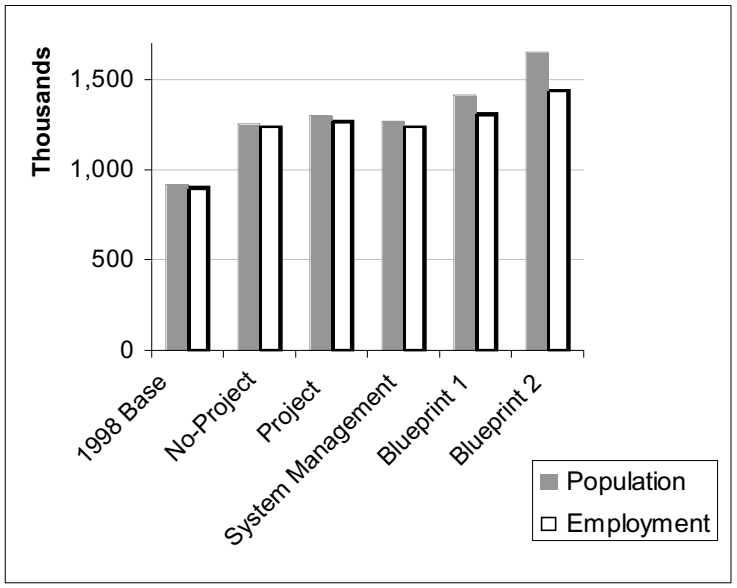
Measure 6: Population and Employment within Walking Distance of Major Transit Intermodal/Rail Stations

Tables A-6 in Appendix A for the complete results for Measure 6.

Comparison of 1998 to 2025

Both population and employment within walking distance of major transit stations are projected to increase from 1998 to the 2025 Project. (See Figure 12.) This results from regional growth in population and jobs and transit expansion projects that include new stations.

Figure 12: Population and Employment within 1/2 Mile of Major Intermodal/Rail Stations, 1998 and 2025



Comparison of Alternatives in 2025

Since land use assumptions are identical in all the 2025 alternatives, differences between alternatives simply reflect the number of new transit intermodal/rail stations in each alternative and where they are located (e.g., dense urban core versus less dense suburban areas).

The System Management Alternative adds the fewest major transit stations because of its emphasis on system operations and express buses rather than rail extensions; the alternative has roughly the same number of people and jobs within walking distance of major transit intermodal/rail stations as does the No Project. The Project Alternative adds more stations with major rail extensions such as BART to San Jose and new Amtrak stations in Solano County and thus results in a slight increase in the number of people and jobs within walking distance of major transit stops at the regional level. Blueprint 1 and

Blueprint 2 add substantially more stations and result in large increases in the number of people and jobs within walking distance: in Blueprint 1, there are 150,000 more people and 70,000 more jobs within walking distance of major transit intermodal/rail stations; in Blueprint 2, there are nearly 400,000 more people and 200,000 more jobs within walking distance of major intermodal/rail stations.

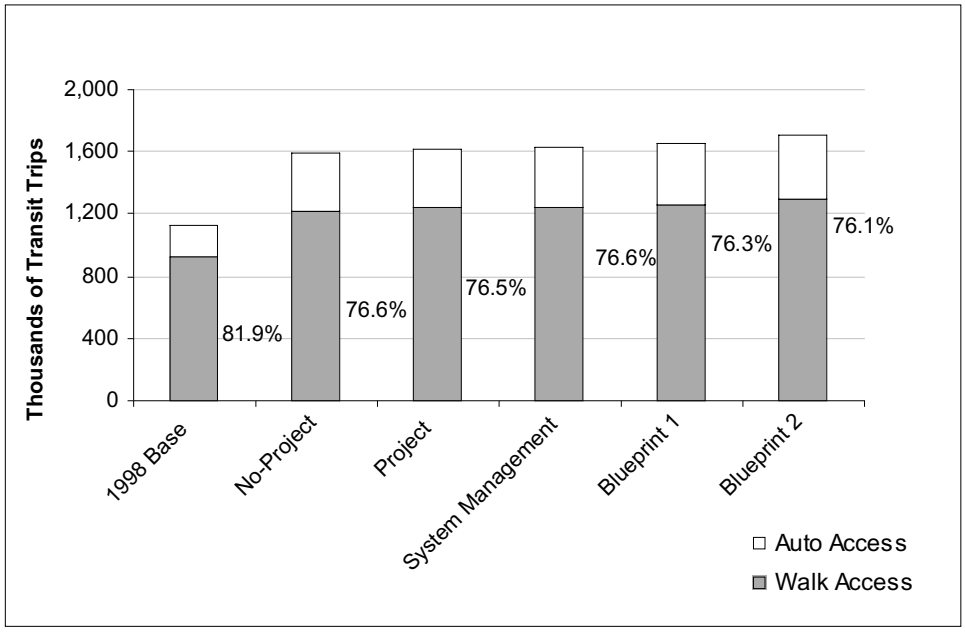
Measure 7: Transit Trips with Walk Access

Tables A-7 in Appendix A for the complete results for Measure 7.

Comparison of 1998 to 2025

Between 1998 and 2025, the number of transit trips with walk access is projected to increase by 300,000. (See Figure 13.) This reflects the significant growth in transit trips overall (about 500,000 new transit trips). However, there will be a decline in the share of regional transit trips with walk access from roughly 82% in 1998 to 77% in the 2025 Project.

Figure 13: Number and Share of Transit Trips with Walk Access, 1998 and 2025



Comparison of Alternatives in 2025

The 2025 alternatives offer only very slight increases, compared to the No Project, in the number of trips with walk access to transit. (See Figure 13.) The differences range from an increase of 23,000 trips (2%) in the Project to nearly 80,000 in Blueprint 2 (7%). These increases are comparable in percentage terms to the increases in total transit trips in the various alternatives, which were shown in Table 3.

It is interesting to note, that while total number of trips with walk access increases from the Project to Blueprint 2, the share of all transit trips that that involve walk access actually decreases somewhat. This may be explained by the fact that many of the new transit trips in the Blueprint Alternatives originate at new stations outside of the urban core, which require more automobile access.

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3.5 THE ENVIRONMENT

Measure 8: Air Quality – Vehicle Emissions

Tables A-8 in Appendix A for the complete results for Measure 8.

Comparison of 1998 to 2025

Vehicle emissions are expected to decrease for some pollutants and increase for others by 2025 as seen in Table 6. Reactive organic gases (ROG) and nitrogen oxide (NOx) are projected to decrease by 74% and 42% respectively. These reductions result from stringent regulations on automobile engines and fuels enacted by the California Air Resources Board. In contrast, both particulate matter (PM_{10}) and carbon dioxide (CO_2) emissions are projected to increase by more than 40% from 1998 to 2025. PM_{10} is related closely to vehicle miles traveled and the major component, road dust, would not be controlled by regulations on emissions from automobile engines (although a portion of the particulates would be produced through combustion). The increase in CO_2 is about the same as that in PM_{10}; CO_2 emissions could be sharply reduced if fuel economy standards were made more stringent by Congress in the future.

Table 6: Motor Vehicle Emissions, 1998 and 2025

			Change 1998 to 2025	
	1998 Base	2025 Project	value	pct.
Transportation Activity Data				
In-Use Vehicles	5,109,000	6,283,000	1,174,000	23%
VMT (000s)	128,000	191,000	63,000	49%
Engine Starts	21,264,000	27,726,000	6,462,000	30%
Vehicle Emissions (Tons/Day)*				
ROG	178.4	46.8	-131.6	-74%
NO_X	251.4	146.3	-105.0	-42%
PM_{10}	60	90	30	50%
CO_2	473.1	671.9	198.8	42%

ROG Budget	TBD once the new Federal air quality plan is submitted
NO_X Budget	TBD once the new Federal air quality plan is submitted

* Emissions based on CARB EMFAC-7G / BURDEN-7G Models except PM10 which includes entrained road dust.

Comparison of Alternatives in 2025

Generally, the 2025 alternatives result in decreases in vehicle emissions from the No Project Alternative, though, Blueprint 1 and Blueprint 2 result in small increases in NOx emissions. (See Table 7.) The Project would have slightly lower emissions than the No Project as a result of investments that increase transit trips, decrease VMT, and improve vehicle operating speeds. The System Management Alternative achieves the most reductions in all pollutants.

Table 7: Motor Vehicle Emissions, 2025 Alternatives

		Change Relative to No Project			
	No Project	Project	System Management	Blueprint 1	Blueprint 2
Transportation Activity Data					
In-Use Vehicles	6,283,000	0	0	0	0
VMT (000s)	192,000	-1,000	-2,000	-2,000	-3,000
Engine Starts	27,777,000	-51,000	-76,000	-90,000	-139,000
Vehicle Emissions (Tons/Day)*					
ROG	49.3	-2.5	-2.9	-2.8	-3.0
NO_X	146.5	-0.2	-0.6	0.7	0.2
PM_{10}	92.0	0.6	0.9	0.9	1.3
CO_2	687.5	-15.7	-21.1	-18.4	-21.0

Conformity Budget	
ROG	TBD once the new Federal air quality plan is submitted
NO_X	TBD once the new Federal air quality plan is submitted

* Emissions based on CARB EMFAC-7G / BURDEN-7G Models except PM10 which includes entrained road dust.

2.4 EQUITY[7]

Measure 9: Travel Time Distribution for Minority and Low-Income Communities

Tables A-9(1) – (2) in Appendix A for the complete results for Measure 9.

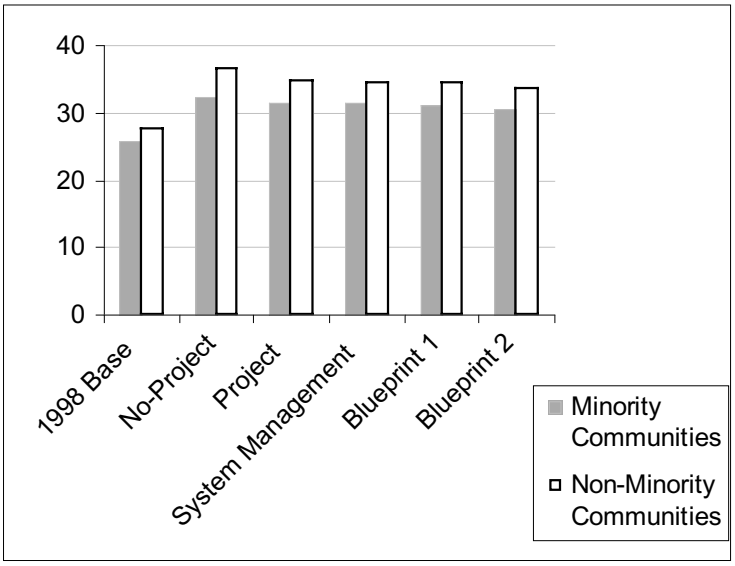
Comparison of 1998 to 2025

In both 1998 and the 2025 Project, travel times are expected to be lower for low-income and minority communities than for other communities. Also, the increases in travel time for minority and low-income communities is lower than that for other communities between 1998 and 2025. Figure 14 shows that the average travel time is expected to increases from 26 to 31 minutes for minority communities and from 28 to 35 minutes for non-minority communities. The change in travel times for low-income communities and not-low-income communities is almost identical, as shown in Figure 15.

Comparison of Alternatives in 2025

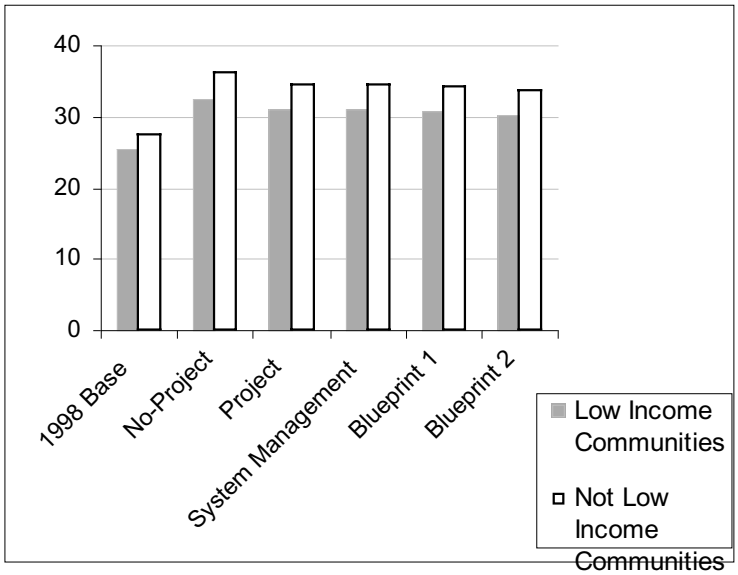
These patterns hold for the 2025 alternatives as well. The figures show that the reductions in average travel time for minority and low-income areas are comparable or better than those for non-minority and not-low-income areas for all 2025 alternatives.

Figure 14: Average Travel Time for Work Trips, Minority and Non-Minority Areas, 1998 and 2025



[7] This report includes only a summary of performance measures under the equity goal. A more complete analysis is included in the Equity Analysis for the 2001 RTP.

Figure 15: Average Travel Time For Work Trips, Low-Income and Not-Low-Income Areas, 1998 and 2025



Measure 10: Accessibility to Jobs for Minority and Low-Income Communities

Tables A-10 in Appendix A for the complete results for Measure 10.

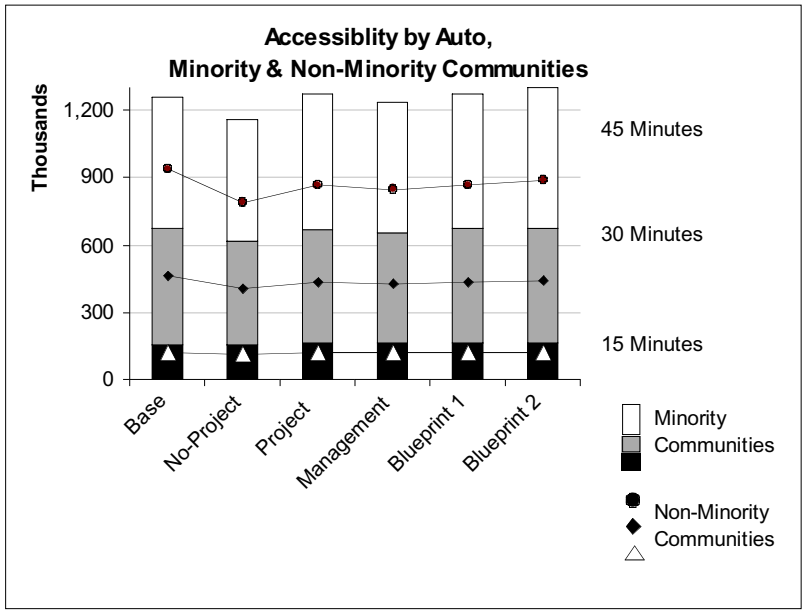
Comparison of 1998 to 2025

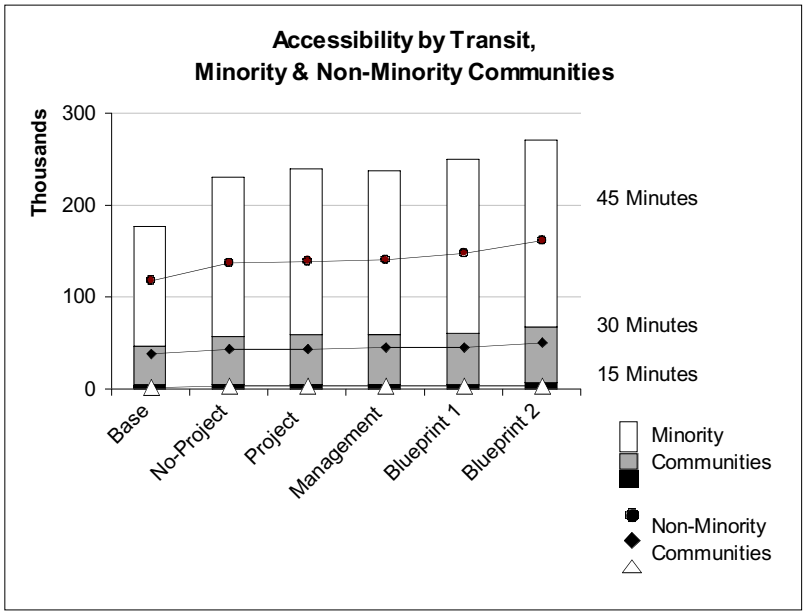
In Measure 3 (Accessibility to Jobs and Shopping) accessibility to jobs by transit, bicycle, and walking is projected to increase from 1998 to the 2025 Project while that by auto is projected to decrease. Figure 16 shows that low-income and minority communities tend to fare as well or better than other communities under these changes. Specifically, auto accessibility decreases the same or less for minority and low-income communities than for other communities, while transit accessibility increases as much or more. Figure 16 also shows that minority and low-income communities are expected to have higher accessibility to jobs by auto and transit than other communities in the 1998 Base and the 2025 Project. The explanation for these results lies in the fact that the low-income and minority communities tend to be located in the urban core and along the region's major transportation corridors.

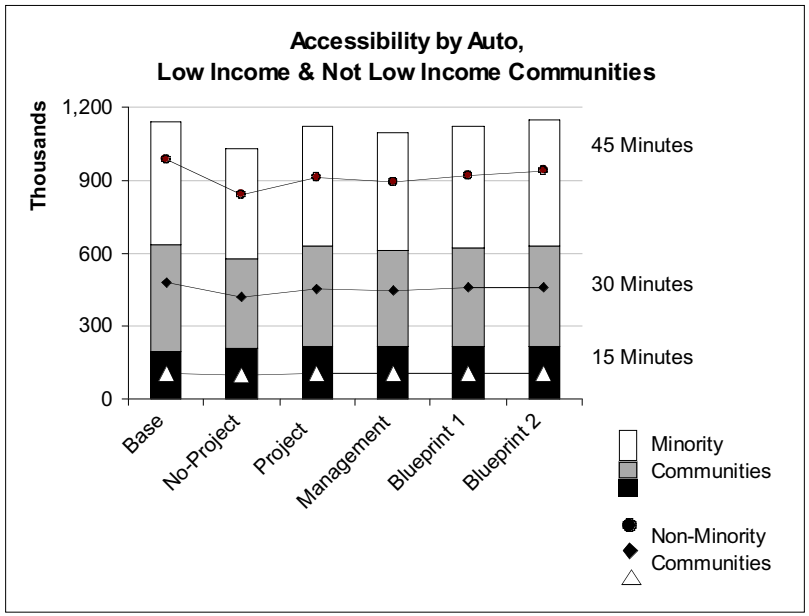
Comparison of Alternatives in 2025

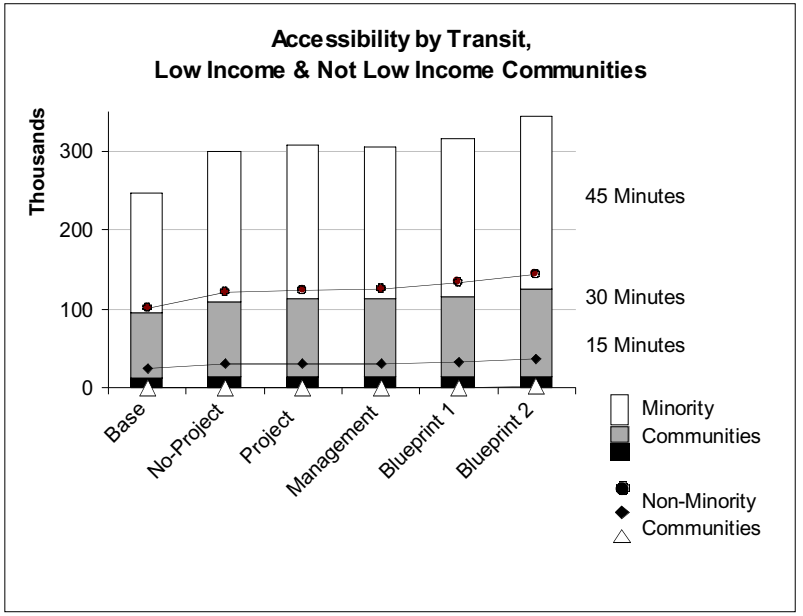
As with Measure 3, the RTP alternatives increase accessibility across the board, with the greatest increases for transit occurring in the Blueprint 2 Alternative. Again, Figure 16 demonstrates that low-income and minority communities will tend to fare as well or better than other communities in the 2025 alternatives. The number of jobs accessible by auto and transit from these communities remains higher than that for other non-target communities for all alternatives.

Figure 16: Accessibility to Jobs for Minority and Low-Income Communities Compared to Other Communities, 1998 and 2025









Measure 11: Transit Travel Time to Select Job Centers from Low-Income and Minority Communities

Tables A-11 in Appendix A for the complete results for Measure 11.

Comparison of 1998 to 2025

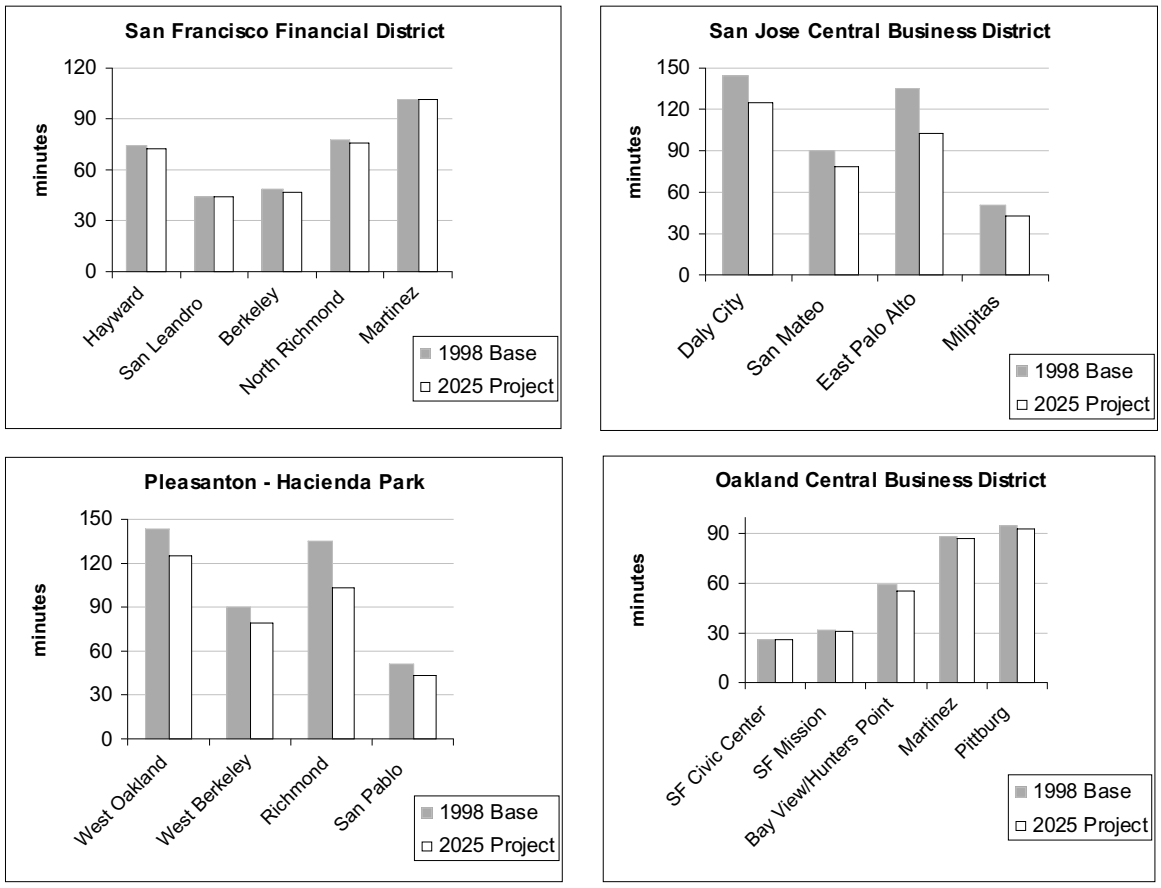
Several of the measures in this report have demonstrated that transit travel times are expected to decrease from 1998 to the 2025 Project due to rail extensions and other transit service enhancements. This is also generally true of transit travel times from low-income and minority communities to the region's job centers. Figure 17 shows transit travel times from the low-income and minority communities to selected job centers.

In some cases, such as travel to the San Francisco Financial Center and the Oakland Central Business District, the improvements in transit travel times are small because the existing transit system is already robust. Transit travel times to the other job centers show larger improvements. For example, travel times to San Jose would decrease as a result of Caltrain improvements and the BART extension included in the 2025 Project Alternative. Transit travel times to Hacienda Business Park would decrease as a result of more BART service.

Comparison of Alternatives in 2025

In most cases, the RTP 2025 alternatives are expected to reduce travel times compared to the No Project as well. (See Tables 11A and 11B in Appendix A.) Again, the reductions are due principally to rail extensions, new express buses, other transit service enhancements, and new carpool lanes. The Blueprint 2 Alternative, which includes the largest number of projects to expand and enhance transit service, produces the greatest reductions in travel time. For example, improvements in transit travel time to San Jose Central Business District from points on the Peninsula reflect Caltrain improvements (such as electrification) in the Project, Blueprint 1 and Blueprint 2 Alternatives. Travel time improvements to Pleasanton and Oakland reflect service improvements in BART and in BART-bus connections.

Figure 17: Transit Travel Times[8] from Minority and Low-Income Communities to Selected Job Centers, Comparison of 1998 Base and 2025 Project



[8] Transit travel times assume walk access.

Chapter 4
Observations and Suggestions for Future RTP Performance Analyses

This section offers preliminary observations and suggestions about the use of performance measures in assessing the RTP and comparing RTP alternatives. These comments relate to the results in this report as well as earlier discussions with the Performance Measure Working Group that helped develop the measures. As the report is reviewed by a larger audience, additional suggestions will certainly emerge and be considered in the ongoing efforts addressing this topic.

OBSERVATIONS

Differences between EIR Alternatives

The $7.7 billion investment program in the RTP Project Alternative represents a rather limited set of improvements on the margin of a well-established system. As reviewed in Chapter 3, new roadway and transit capacity in the RTP Project amounts to increases of 2% and 8% respectively from the No Project Alternative, and thus the performance results were not expected to be significantly different between these two options. The analysis also demonstrates that the improvements and strategies in the System Management and Blueprint Alternatives do have a measurable impact on the performance measures results. Furthermore, the impact occurs in the expected direction, i.e., a more robust system provide across-the-board improvements in the measures.

Travel Demand Models

There has been a concern among some working group participants that the existing MTC travel demand model may not support some measures that will ultimately prove to be useful. The regional travel demand model was developed to provide credible results at the regional and corridor levels to support major investment decisions. Some people would like to see greater focus on non-motorized trips or consideration of the impacts of smaller-scale projects on local communities. This would require a major investment in data collection and model refinement.

Interest in Measures not Analyzed

There was extensive discussion among the working group participants about the appropriateness of a few measures that ultimately were not included in this report: congestion, vehicle miles traveled (VMT) and transportation mode share. (These statistics are reported elsewhere, such as in the RTP itself and the EIR.) Some feel that the lack of a measure of congestion is a significant shortcoming since data and common experience suggest that traffic congestion increased dramatically with the recent economic boom, focusing public attention on the need for increased efforts to reduce congestion. Other people feel that measuring congestion puts too much emphasis on congestion relief for automobiles and that there ought to be an equal emphasis on improvements for users of all modes of transportation. Similarly, participants in the working group differed on the importance of including VMT and transportation mode share as performance measures. Some argue that reduction of VMT and a shift in mode share away from automobiles should be pursued as objectives in and of themselves. Others argue that these are ambiguous measures. For example, increasing VMT may represent greater mobility and, as

shown in this report does not imply a worsening of air quality in the form of ozone once the tough controls on auto emissions and fuels are factored into the calculations.

The issue of project evaluation has also been well discussed and remains unresolved. There are over 200 projects in the 2001 RTP. Major projects undergo extensive analysis and public review at the local level through corridor studies and in the environmental review process. These studies are based on specific project objectives and are conducted at a more detailed level than is possible in the RTP. Some working group participants felt it would be beneficial to conduct a less detailed but uniform analysis of all projects proposed for inclusion in the RTP based on a common set of objectives and methodologies. Others believe this would duplicate the project-level studies that are already required and would lead to "second guessing" of the conclusions from more comprehensive local analyses. These participants point out that many of the studies have already undergone extensive public review and involvement by the time the projects are submitted for inclusion in the RTP.

SUGGESTIONS

Implement a Program to Monitor Performance of the Existing System

A number of aspects of system performance of interest to the public cannot be reasonably forecasted into the future as is required in the RTP development, e.g., reliability of travel time, safety, and customer satisfaction. All members of the working group agreed it is possible and worthwhile to assess these aspects through a system monitoring program which could show how the performance of the existing system is changing over time.

Streamline the Performance Measure Report by Reducing the Amount of Data

This report should be streamlined by reducing rather than expanding the number of measures and the number of elements reported for each measure. A primary objective is to present the performance results in a manner that is easy to understand and that focuses attention on the most important measures. The number of measures and, in particular, the fact that several measures have numerous sub-elements, made this task extremely challenging. Ultimately, the performance results for many of the sub-elements were relegated to the appendices as the amount of data was simply overwhelming.

Develop Objectives for the Goals

A recurrent theme was the lack of specific objectives for each RTP goal. Several working group members believed that having explicit objectives was a necessary element in the design of a performance measures approach. However, some objectives may, like the goals themselves, be difficult to assess quantitatively. One possibility may be to use qualitative measures for certain goals, thus replacing more complicated measures with less complicated and more intuitive measures.

Suggestions for Specific Measures

Table 8 lists suggestions for specific performance measures based on the preparation of this report. Some suggestions apply to more than one measure. These are discussed below:

- Measures that rely on selection of a few individual geographic /analysis zones may under-represent trends in a larger market. Measures 2, 4, and 10 are examples. As currently

calculated, they require identification of specific neighborhoods/zones which are represented in the MTC . Performance measures results are potentially overly sensitive to modeling assumptions. It may be better to use a method that allows groups of neighboring zones to be analyzed as being more representative of a market, if such a method could be developed.

- The accessibility measures under mobility, economic vitality and equity (Measures, 3, 4 and 11) are compromised since they likely underestimate benefits because they depend on specific travel time contours (or isochrones). For example, a case in which travel time improves from 29 minutes to 20 minutes will not be recognized as a benefit because the change does not cross one of the travel time thresholds (15, 30, 45 minutes); yet this change is more significant than a shift from 46 to 44 minutes, which would be counted. The isochron-bsed measures chosen for this report were used because it was felt that they were more readily understood than alternative methodologies; however, it is probably worthwhile to give further consideration to alternatives.

Table 8: Suggestions for Specific Measures

Measure	Suggestion
Measure 1: Aggregate travel time and travel time distribution (average, median, and 90th percentile travel time)	• Not clear that it is useful to report the median and 90th percentile travel time, given the additional work required. The changes in these values are consistent with those for the average travel time.
Measure 2: Travel time between select origin and destination pairs	• Results are highly dependent on the specific origins and destinations selected and thus may not be totally representative. • Simplify by reducing the number of pairs considered in the appendices.
Measure 3: Accessibility to jobs and shopping	• Likely underestimates benefits. • Simplify by eliminating accessibility to shopping, as the differences among alternatives mirrored those for all jobs. • If isochronal method is retained, simplify by measuring the number of accessible jobs rather than the share. • Do not report walk and bike access unless there are changes in land use assumptions.
Measure 4: Access of employers in major job centers to the region's workforce	See notes for Measure 3. This measure is less useful than Measure 3 due to need to identify a few specific zones.
Measure 5: Net benefit/Cost benefit ratio	• Limited information on project costs prohibited calculation of the complete measure for alternatives other than the Project.

Measure	Suggestion
Measure 6: Population and employment within _ mile of major rail/transit intermodal stations	• Measure is most meaningful if there are changes in land use assumptions.
Measure 7: Number of trips that use walking to access transit	• Measure is most meaningful if there are changes in land use assumptions.
Measure 8: Vehicle emissions	None
Measure 9: Travel time distribution for minority and low-income communities	See comments for Measure 1
Measure 10: Accessibility to jobs from minority and low-income communities	See comments above for Measure 3.
Measure 11: Transit travel time to major job centers from minority and low-income communities	See comments for Measure 4.